LISTING OF CLAIMS

1. (canceled) A linear stepper motor, comprising;

(a) an annular stator structure;

(b) an axially extending, cylindrical, permanent magnet shaft extending coaxially through said annular stator structure; [and]

(c) said axially extending, cylindrical, permanent magnet shaft having a smooth external surface along a portion thereof with axially alternating N and S poles defined circumferentially in an outer periphery of said portion of said axially extending, cylindrical, smooth, permanent magnet shaft; [and]

(d) said axially extending, cylindrical, permanent magnet shaft is formed from one homogeneous piece of material; and

(e) said portion of said axially extending, cylindrical, permanent magnet shaft is hollow.

2. (canceled) A linear stepper motor, as defined in Claim 1, wherein: said portion of said axially extending, cylindrical, permanent magnet shaft is hollow.

3. (canceled) A linear stepper motor, as defined in Claim 1, wherein: said portion of said axially extending, cylindrical, permanent magnet shaft has a solid core.

4. (canceled) A linear stepper motor, as defined in Claim 3, wherein: said solid core is formed from a ferromagnetic material.

5. (canceled) A linear stepper motor, as defined in Claim 3, wherein: said solid core is formed from a non-magnetic material.

6. (canceled) A linear stepper motor, as defined in Claim 1, wherein: said stator structure includes annular disks of a high lubricity material spacing apart elements of said stator structure and serving as bearing surfaces for said axially extending shaft.

7. (canceled) A linear stepper motor, as defined in Claim 1, wherein: at least said portion of said axially extending, cylindrical, smooth, permanent magnet shaft is constructed of a single piece of material.

8. (cancelled)A linear stepper motor, as defined in Claim 1, wherein: said axially extending, cylindrical, smooth, permanent magnet shaft can rotate 360° continuously or intermittently in any direction, regardless of whether or not said linear stepper motor is energized.

9. (canceled) A linear stepper motor, as defined in Claim 1, wherein: said axially extending, cylindrical, smooth, permanent magnet shaft is back-driveable.

10. (canceled) A linear stepper motor, as defined in Claim 1, wherein: said linear stepper motor is constructed to operate in any orientation.

11. (canceled) A linear stepper motor, as defined in Claim 1, wherein: said stator structure has modular stator stacks with pole pieces to concentrate and direct magnetic flux.

12. (canceled) A linear stepper motor as defined in Claim 1, herein: said stator structure has conventionally wound coils.

13. (cancelled) A linear stepper motor, as defined in Claim 1, wherein said linear stepper motor includes no bearings.

14. (canceled) A linear stepper motor, as defined in Claim 1, wherein: said linear stepper motor includes no lead screw and no ball screw.

15. (canceled) A linear stepper motor, as defined in Claim 1, wherein: said linear stepper motor requires no lubrication of coengaged parts thereof.

16. (canceled) A linear stepper motor, as defined in Claim 1, wherein: said linear stepper motor requires no conversion of rotary motion to linear motion.

17. (withdrawn)A fixture for magnetizing axially alternating N and S poles defined circumferentially in a portion of an outer periphery of an axially extending, cylindrical, smooth shaft, said fixture comprising:

(a) a hollow cylindrical mandrel formed from a non-magnetic, non-electrically-conducting material;

(b) a conductive wire disposed in parallel, circumferential channels defined in an outer surface of said mandrel;

(c) a potting compound surrounding said mandrel to secure said conductive wire in place; and

(d) a central bore defined axially and centrally through said mandrel and exposing or nearly exposing said conductive wire; and

(e) said central bore being sized to accept axially inserted therein said portion of said axially extending, cylindrical, smooth shaft.

18. (withdrawn) A fixture, as defined in Claim 17, wherein: said conductive wire is placed in said parallel, circumferential channels such that direction of flow in said conductive wire of a direct current in adjacent ones of said parallel, circumferential channels is in opposite directions.

19. (withdrawn) A method of providing axially alternating N and S poles in a portion of an axially extending, cylindrical, smooth shaft for a linear stepper motor, comprising:

(a) providing a magnetizing fixture comprising: a hollow cylindrical mandrel formed from a non-magnetic material; a conductive wire disposed in parallel, circumferential channels defined in an outer surface of said mandrel; a potting compound surrounding said mandrel to secure said conductive wire in place; and a central bore defined axially and centrally through said mandrel and exposing or nearly exposing said conductive wire; and said central bore being sized to accept axially inserted therein said portion of said axially extending, cylindrical, smooth shaft;

(b) inserting said portion of said axially extending, cylindrical shaft in said central bore; and

(c) providing a direct current through said conductive wire said conductive wire is placed in said parallel, circumferential channels such that direction of flow in said conductive wire of a direct current in adjacent ones of said parallel, circumferential channels is in opposite directions.

20. (withdrawn) A method, as defined in Claim 19, further comprising: providing said conductive wire placed in said parallel, circumferential channels such that direction of flow in said conductive wire of a direct current in adjacent ones of said parallel, circumferential channels is in opposite directions.

21. (withdrawn) A method of manufacturing a magnetizing fixture for magnetizing axially alternating N and S poles defined circumferentially in a portion of an outer periphery of an axially extending, cylindrical, smooth shaft, said method comprising:

(a) providing a plurality of parallel, circumferential channels defined in an outer surface of a cylindrical mandrel formed from a non-magnetic material;

(b) placing a conductive wire in said parallel, circumferential channels;

(c) providing a potting compound surrounding said mandrel to secure said conductive wire in place;

(d) forming a central bore defined axially and centrally through said mandrel and exposing or nearly exposing said conductive wire; and

(e) said central bore being sized to accept axially inserted therein said portion of said axially extending, cylindrical, smooth shaft.

22. (withdrawn) A method, as defined in Claim 21, further comprising: providing said conductive wire placed in said parallel, circumferential channels such that direction of flow in said conductive wire of a direct current in adjacent ones of said parallel, circumferential channels is in opposite directions.

23. (currently amended) A linear stepper motor, comprising:

(a) an annular stator structure;

(b) an axially extending, cylindrical, permanent magnet shaft extending coaxially through said annular stator structure;

(c) said axially extending, cylindrical, permanent magnet shaft having a smooth external surface along a portion thereof with axially alternating N and S poles defined circumferentially in an outer periphery of said portion of said axially extending, cylindrical, smooth, permanent magnet shaft;

(d) said portion of said axially extending, cylindrical, permanent magnet shaft has a solid core; ~~and~~

(e) said solid core is formed from a non-magnetic material; and

(f) said stator structure includes annular disks of a high lubricity material spacing apart elements of said stator structure and serving as bearing surfaces for said axially extending shaft.

24. (previously presented) A linear stepper motor, comprising;

(a) an annular stator structure;

(b) an axially extending, cylindrical, permanent magnet shaft extending coaxially through said annular stator structure;

(c) said axially extending, cylindrical, permanent magnet shaft having a smooth external surface along a portion thereof with axially alternating N and S poles defined circumferentially in an outer periphery of said portion of said axially extending, cylindrical, smooth, permanent magnet shaft; and

(d) said stator structure includes annular disks of a high lubricity material spacing apart elements of said stator structure and serving as bearing surfaces for said axially extending shaft.

25. (canceled) A linear stepper motor, as defined in Claim 23, wherein: said stator structure includes annular disks of a high lubricity material spacing apart elements of said stator structure and serving as bearing surfaces for said axially extending shaft.

26. (previously presented) A linear stepper motor, as defined in Claim 23, wherein: said axially extending, cylindrical, smooth, permanent magnet shaft can rotate 360° continuously or intermittently in any direction, regardless of whether or not said linear stepper motor is energized.

27. (previously presented) A linear stepper motor, as defined in Claim 23, wherein: said axially extending, cylindrical, smooth, permanent magnet shaft is back-driveable.

28. (previously presented) A linear stepper motor, as defined in Claim 23, wherein: said linear stepper motor is constructed to operate in any orientation.

29. (previously presented) A linear stepper motor, as defined in Claim 23, wherein: said stator structure has modular stator stacks with pole pieces to concentrate and direct magnetic flux.

30. (previously presented) A linear stepper motor as defined in Claim 23, wherein: said stator structure has conventionally wound coils.

31. (previously presented) A linear stepper motor, as defined in Claim 23, wherein: said linear stepper motor includes no lead screw and no ball screw.

32. (previously presented) A linear stepper motor, as defined in Claim 23, wherein: said linear stepper motor requires no lubrication of coengaged parts thereof.

33. (previously presented) A linear stepper motor, as defined in Claim 23, wherein: said linear stepper motor requires no conversion of rotary motion to linear motion.

34. (previously presented) A linear stepper motor, as defined in Claim 24, wherein: said portion of said axially extending, cylindrical, permanent magnet shaft is hollow.

35. (previously presented) A linear stepper motor, as defined in Claim 24, wherein: said axially extending, cylindrical, smooth, permanent magnet shaft can rotate 360° continuously or intermittently in any direction, regardless of whether or not said linear stepper motor is energized.

36. (previously presented) A linear stepper motor, as defined in Claim 24, wherein: said axially extending, cylindrical, smooth, permanent magnet shaft is back-driveable.

37. (previously presented) A linear stepper motor, as defined in Claim 24, wherein: said linear stepper motor is constructed to operate in any orientation.

38. (previously presented) A linear stepper motor, as defined in Claim 24, wherein: said stator structure has modular stator stacks with pole pieces to concentrate and direct magnetic flux.

39. (previously presented) A linear stepper motor as defined in Claim 24, wherein: said stator structure has conventionally wound coils.

40. (previously presented) A linear stepper motor, as defined in Claim 24, wherein: said linear stepper motor includes no lead screw and no ball screw.

41. (previously presented) A linear stepper motor, as defined in Claim 24, wherein: said linear stepper motor requires no lubrication of coengaged parts thereof.

42. (previously presented) A linear stepper motor, as defined in Claim 24, wherein: said linear stepper motor requires no conversion of rotary motion to linear motion.